

AN EXTRAORDINARY SHARK.

BY SAMUEL GARMAN.



CHLAMYDOSELACHUS ANGUINEUS.

*Measurements.*—Total length 59.5; snout to angle of mouth 4.5, to back of skull 4.25, to occipital pores 3.9, to end of gill covers 7., to end of pectorals 14.25, to vent 35.5, to base of ventrals 32., to end of ventrals 38.6, to base of anal 39.75, to end of anal 47.6, to base of dorsal 42.25, to end of dorsal 47.75, to base of caudal 48.5; greatest width across ventrals 7., greatest width across caudal 5., greatest width across dorsal and anal 6.5, greatest circumference of body 11.5, width of head across eyes 3.5, width of teeth between the outer prongs (length of longest prong little less) .25 inches.

Rows of teeth  $\frac{1}{3}$  · 9 ·  $\frac{1}{3}$ .

Rays on hyomandibular and ceratohyal (first branchial arch) 22, on second arch 15, third 14, fourth 12, fifth 9, sixth 6, and on the seventh none.

Hab., Japanese seas.

*Description.* Body very long, slender, eel-like, increasing in size comparatively little anteriorly, compressed near and behind the vent, which is in the posterior half of the total length. Head broad, wider than high. Crown slightly convex forming a rather sharp angle with the snout and sides of the head, from the eyes forward. Skull with an anterior foramen, beginning a short distance in front of a vertical from the front edge of the orbit, resembling that of *Raja*. Behind this, midway between the eyes, there is an elongate depression on the crown as of a second foramen, while on the occiput a little distance in front of the occipital pores a deep rounded depression indicates what is commonly called the second, the posterior foramen. Snout broad, rounded, hardly extending in front of the jaws, rather acute-angled or shovel-shaped at the top. Nostril moderate, vertical, separated by a fold from each side into an upper opening looking forward and a lower one looking backward, situated about midway from eye to end of snout and near the middle of the space from top of head to mouth. Eye moderately large, orbit elongate, near a vertical from the middle of the length of the mouth. Spiracle very small, over the hyomandibular; its distance behind the eye equal to that from eye to

end of snout. Mouth cleft very deep, slightly curved, extending as far back as the skull. Roof and floor of mouth covered with sharp scales, the former curving upward very strongly behind the teeth between the nostrils. Upper and lower jaws about equal in length. Lips without a groove or labial fold. Glossohyal cartilage (basihyal) prominent above the floor of the mouth and free at its extremity about half an inch, forming a tongue. Teeth small, similar in both jaws, several in each row in function at the same time, each with three long, smooth, curved, backward directed, slender, very sharp cusps — each of which bears some resemblance to a serpent's tooth. A small cusp on the base at each side of the central. Bases of teeth broad, extending inward about the length of the cusps, terminating in two prongs (see fig.) which, extending beneath the base of the next tooth, prevent the possibility of reversion or turning the cusps forward. Fourteen rows of teeth on each side on the upper jaws, no median series. A median row on the symphysis of the lower jaws, its teeth similar in size and shape to those of the thirteen rows on each side of it. Hyomandibular and ceratohyal closely and somewhat firmly connected with the jaws at the hinge or hinder angle of the latter. Branchial arches long, very slender, with sharp small scales on their inner edges. Without dissecting, twenty-two branchial rays can be counted on the hyomandibular and ceratohyal (the first arch) and on the succeeding six arches, in order, 15, 14, 12, 9, 6, and 0 respectively. In most cases the outer extremities of the rays are produced in a sharp flexible point beyond the adjacent margin of the gill covers. Gill openings very wide, oblique, the opposite series very narrowly separated on the throat, the fourth in front of a vertical from the pectoral and the fifth and sixth extending back above the shoulder. A broad opercular flap covers the first

branchial aperture and is continuous and free across the isthmus, forming a frill or ruffle; it is held in place and prevented from turning forward by a thin fold or wall of membrane, near an inch in height, attached immediately beneath the middle of the basihyal. The external distribution of slime-canals is about as follows: starting above the nostril in front of the eye a line turns backward along each side of the skull and, after receiving a branch from behind the eye, continues along the middle of each flank to the extreme end of the vertebral column in the tail, where it makes an abrupt turn downward for about a quarter of an inch; under the chin on each side, a line runs along the mandible and curving upward disappears behind the angle of the mouth; a branch of this, beginning nearly on a vertical beneath the middle of the space between eye and nostril, runs farther from the mouth and turning upward near the margin of the opercular flap after receiving a short branch behind the angle of the mouth, continues to a point a very short distance behind the spiracle, a small branch coming into it near the end from the direction of the corner of the mouth. Pectorals moderate, broad, rounded. Dorsal comparatively small, its posterior extremity extending as far back as that of the anal, angle blunt. The upper margin of the dorsal is armed with a series of enlarged, compressed, chisel-shaped scales, which extends forward on the back to a vertical from the vent, a few of the anterior being horizontally flattened. Ventrals large, broad—a little broader than long, rounded, posterior angle acute. Anal broad, long, rounded, acute-angled posteriorly. Caudal long, very broad, rounded anteriorly, posterior angle acute—produced into a filamentary point, margin very thin or membranaceous. Above the muscular vertebral portion of the tail there is a narrow expanse of fin, widening backward, the edge of which is armed by a

sharp series of chisel-shaped scales, and extended downward behind the end of the vertebral column, where it becomes about three-sixteenths of an inch in width. That it is the dorsal portion of the fin which descends is proved by the change in the direction of the points of the scales and of the mucus canal. The dorsal portion of the fin is plainly indicated on the hinder margin of the tail about half-way down to the filamentary point. The chisel-shaped scales are in reality formed from two series (one belonging to each side of the body) which have coalesced. Though small and harsh to the touch the scales on the body are not sharp; they offer about the same resistance from whatever direction the finger may be passed over them. On the tail, however, they are very sharp and the points are directed backward. Along the edges of the canals on both body and tail the scales are compressed and flattened; they form the only cover or protection for these organs, which in the specimen described have the appearance of long seams or grooves. On the skull these canals do not stand open as on the rest of the body. Near the mouth and especially toward its angle the scales are larger and more prominent. Under the middle of the belly, the skin forms two closely approximated rolls or ridges separated by a groove, and inside of these the muscle is thicker than towards the flanks. Intestine very small, valve spiral. Abdominal pores opening behind the vent, protected by a fold. Cartilages soft and flexible as those of *Somniosus* or *Selache*. Uniform brown, darker at the thin margins of the fins. Specimen described, a female, apparently adult, purchased by the Museum of Comparative Zoology from Professor H. A. Ward, who gives Japan as the locality.

The accompanying outlines are taken from the animal as it lies on the belly showing the back of the middle of the

body and the sides of the head and tail. The smaller sketches show the upper and lower surfaces of the head. The smallest figures give the outlines of a tooth viewed from above and from the sides.

From the foregoing it appears that there is neither genus nor family to which the species described may properly be assigned. The characters given below are selected for provisional diagnoses.

**CHLAMYDOSELACHUS.** Branchial apertures six. Opercular flap broad, free across the isthmus. Teeth similar in both jaws, with slender subconical cusps and broad backward produced bases. No teeth in the middle in front above ; a row on the symphysis below. Mouth wide, anterior ; no labial fold. No nictitating membrane. Fins broad, pectorals far in advance of the others. Caudal without a notch posteriorly. Gill arches slender, long, basihyal not wide. Intestine small.

**CHLAMYDOSELACHIDÆ.** Body much elongate, increasing in size very little anteriorly. Head depressed, broad. Eyes lateral, without nictitating membrane. Nasal cavity in skull separate from that of mouth. Mouth anterior. Snout broad, projecting very little. Cusps of teeth resembling teeth of serpents. Spiracles small, behind the head. One dorsal, without spine. Caudal without pit at its root. Opercular flap covering first branchial aperture free across the isthmus. Intestine with spiral valve.

*Remarks.* Such an animal as that described is very likely to unsettle disbelief in what is popularly called the "sea serpent." Though it could hardly on examination be taken for anything but a shark, its appearance in the forward portion of the body, particularly in the head, brings vividly to mind the triangular heads, deep-cleft mouths, and fierce looks of many of our most dreaded snakes. In view of the possible discoveries of the future, the fact of the existence of such creatures, so recently undiscovered, certainly calls for a suspension of judgment in regard to the non-existence of that oft-appearing but elusive creature, the serpent-like monster of the oceans.

Generally the attitude of ichthyologists in respect to the belief in unknown sea monsters is much the same; they are inclined to accept it but are waiting more definite information. A couple of years ago Professor Baird in a conversation on the subject drew a sketch of a strange creature, captured and thrown away by a fisherman on the coast of Maine, which might be readily considered by the ordinary observer as a form of "the serpent." It was some twenty-four feet in length, ten inches in diameter, eel-like in shape, possessed of a single dorsal placed near the head, and had three gill openings. The question was "is it a shark?" In several respects it resembled an eel rather more. An outline and the correspondence in relation to it have recently been published in the Proceedings of the Fish Commission.

Notwithstanding the possession of peculiarities which prevent its entrance into any of the known families of the order, the subject of the present communication is a veritable shark. A diameter of less than four inches to a length of five feet marks one of the slenderest of the tribe. Whether it attains much greater length we can only judge,

from the structure and apparent age of the specimen, to be probable. The delicate margins and filaments of the fins are those of an inhabitant of the open sea or considerable depths. Bottom feeders are provided with larger spiracles and the fins usually show signs of wear. Rapidity of movement is suggested by the large amount of surface in the posterior fins. It is probable, however, that the large fins, being so far back, are of importance as support for the body when the anterior portion is quickly plunged forward to seize the prey; that is, they secure a fulcrum from which the animal may strike like a snake. The anterior fins (pectorals) being only of moderate size are yet ample for balancing or directing the body when in motion however rapid.

There is a correspondence between the size of the gill openings and that of the mouth; no matter how widely the latter may be opened when rushing upon the prey, the immense branchial apertures allow the water to pass through without obstruction. Favoring the idea of rapidity of movement still further are the peculiarities in the structure of the nostrils. By means of a fold from each side of the vertically elongated nostril it is divided into what appears to be two nasal apertures. Of these the upper looks forward and catches the water as it is met turning it into the cavity upon the membranes of the interior; while the lower opens backward allowing the water to escape after passing over the olfactory apparatus. In case of the upper opening it is the hinder margin that stands out farthest from the head and in the lower aperture it is the forward edge that is prominent. In fact the structure is such that the slightest forward movement will send a current of water in at the upper portion of the nostril and out at the lower while a move backward will simply reverse



the order making the current enter below and escape above. In most Selachians this current is secured by means of the nasal valve, which covers about half of each nostril.

The teeth are constructed for grasping and from their peculiar shape and sharpness it would seem as if nothing that once came within their reach could escape them. Even in the dead specimen the formidable three-pronged teeth make the mouth a troublesome one to explore. Points of teeth in perfect preservation, shape of the cusps, and the structure of the small portion of the intestine left by the captor, leave little room for doubt that the food of the creature was such as possessed comparatively little hardness in the way of the mail or other armature.

No other shark of which we know has the opercular flap free across the throat. In this particular it recalls the fishes. There is a certain embryonic look about the species, as others who have seen it also remark, that calls for a comparison with fossil representatives of the Selachians. Among them I have been unable to find anything which might be considered at all near. In *Cladodus* of the Devonian there is a form with teeth somewhat similar, a median and two lateral cones on each tooth, but the cones are straight instead of curving backward, and the enamel is grooved or folded instead of smooth. However, the type is one which produces the impression that its affinities are to be looked for away back, probably earlier than the Carboniferous, when there was less difference between the sharks and the fishes.